Cosmic Ray Proton Velocity

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Nikola Tesla, the discoverer of the cosmic rays, stated that their velocity was greater than the speed of light. But he was not able to calculate just what it was. We will do so here. We commence with the following observation: To construct an equation showing the tremendous energy involved, we must have either (1) a great mass for the proton, or (2) a velocity greatly in excess of *c*. It cannot be done using c and the bare proton mass. Since no bremsstrahlung is observed when the proton comes to rest, we must conclude that it has its bare mass and the velocity is way in excess of *c*.

1. Introduction

Einstein's equation for kinetic energy $E=(\gamma-1)mc^2$ has been tested and shown correct, where

$$\gamma \equiv \frac{1}{\sqrt{1-v^2/c^2}} \tag{1}$$

Wikepedia gives the energy E of a cosmic ray proton as approximately 10^{20} eV or 10^{14} MeV. Therefore

$$E=(\gamma-1)mc^2 \approx \gamma mc^2 \approx 10^{14}\,\text{MeV} \approx 1.60 \times 10^{8}\ \text{ergs}. \tag{2}$$

Since the mass of a proton is $1.67262158 \times 10^{-24}$ g ,

$$\gamma \approx \frac{E}{mc^2} \approx \frac{1.60 \times 10^{8}\ \text{ergs}}{\left(1.67 \times 10^{-24}\ \text{g}\right)\left(3.00 \times 10^{10}\ \text{cm/s}\right)^2} = 1.06 \times 10^{11} \tag{3}$$

Lest you think Eq. (3) comes from Eq. (2), below are equations from the author's work that produce γ from super *c* velocities.

Note, since the Lorentz transforms do not exist in the super *c* range, all velocities there are Newtonian. Thus Eq. (5) is valid for the Newtonian velocities in the relativistic range as well as the Newtonian velocities of the super *c* range. Squaring Eq. (1)

$$\gamma^2 - \frac{\gamma^2 v^2}{c^2} = 1. \tag{4}$$

And thus, defining Newtonian velocity $V \equiv \gamma v$,

$$\gamma = \sqrt{1+V^2/c^2}. \tag{5}$$

This equation is inoperative at $v=c$, since $V=\infty$. Thus, the equation yields $\gamma=\infty$, which is not a number. Thus the equation is incorrect and therefore inoperative.

More accurately, as $v \to c$, $V \to \infty$, which means the range of V is 0 to ∞. And γ can be found by Eq. (5) for any Newtonian (proper) velocity. In the relativistic realm γ can be found by any relative velocity of $0 \to c$, by use of the Lorentz transform.

2. Newtonian Velocity

Next, we ask – given γ , what is the associated velocity? Just as there are two lengths to a fast moving rod – the length at rest in the moving coordinate system (proper length), and the length observed in the considered at rest system (relative length) – there are two velocities. The length of a rod is a distance, and distance with respect to time is velocity. The observed velocity is relative velocity and the velocity of the observed system is Newtonian (proper) velocity. [1]

Eq (5) gives

$$V=\sqrt{\gamma^2-1}\cdot c \approx \gamma c = 106{,}000{,}000{,}000c = 3.19 \times 10^{21}\ \text{cm/s}. \tag{6}$$

Believe it or not! If this seems too high, recall that the energy creating it is on the order of our sun's total energy output for 150,000 years!! Both are mind staggering.

Note, although it is difficult for the Lorentz transform to process this velocity, due to the author's theories, he was able to bypass it and acquire comparable results for velocities greater than *c* in Eq (5). Assuredly, the γ for super *c* velocities is correct. Since the Lorentz transform for super *c* velocities doesn't exist, γ is called the "the transform operator".

In short, the Lorentz transformation due to its structure is inoperative at *c* or above. However, the author developed a relativistic equation for energy with a different structure than Einstein's but which gives exactly the same result. It is helpful to work with the reciprocal of γ , which I here call ρ . From Eq. (1)

$$\frac{v^2}{c^2} = 1 - \frac{1}{\gamma^2} = 1 - \rho^2 \tag{7}$$

=> $$E=(\gamma-1)mc^2 = \left(\frac{\gamma-1}{1-\frac{1}{\gamma^2}}\right) mv^2 = \frac{\gamma^2 mv^2}{\gamma+1} = \frac{mv^2}{\rho(\rho+1)}. \tag{8}$$

Or since $V \equiv \gamma v$, hence $v=\rho V$

$$E = \frac{mV^2}{\gamma+1} = \frac{\rho}{\rho+1} mV^2 \tag{9}$$

The author also altered this equation to serve all Newtonian velocities, 0 to ∞. It will be found that determining ρ by use of the Lorentz transform, and ρ by use of Eq. (5) yields the same result. However, with the transforms, relative velocities are used whereas in Eq. (5) Newtonian velocities must be used.

As it turns out, energy can be determined by Eq. (6) for all velocities. There is one restriction, however: IT IS A NEWTONIAN VELOCITY EQUATION -- AND NEWTONIAN VELOCITIES MUST BE USED THROUGHOUT.

Below *c*, the relativistic velocity can be converted to Newtonian by $v = \rho V$ [1] Note: ρ is obtainable from super *c* velocities by Eq. (5). It is also obtainable from the mass and energy of a particle by Eq. (2).

If one doubts the result here, recall that ρ for this velocity, when inserted into Einstein's equation, GIVES THE CORRECT ENERGY FOR THE PROTON as ascertained in the laboratory. It also works in Eq. (9).

A counter argument may be proposed to the effect that ρ of 9.383323 x 10^{-12} can be obtained from the Lorentz transform. True but Einstein's equation calls for a mass increase $(\gamma - 1)m$, which violates the modern agreement that mass is velocity invariant, i.e. relative mass does not exist. So the equation is invalid (if one believes an equation must represent reality).

The correct equation is Eq. (9). Note: the ρ in that equation is not a Lorentz transform but is obtained from Eq. (5) where *V* is Newtonian. For sub *c* relative velocities, the energy equation is

$$E = \frac{mv^2}{\rho(1+\rho)} . \tag{10}$$

For sub *c* velocities, the Lorentz transform ρ is valid but there is no mass increase so the equation is valid and the correct equation to use, also we see *v* is trans *c*. Note, at very low velocities $\rho \approx 1$, and Eq. (10) takes the Newtonian form $E = mv^2/2$.

What is the relationship between energy and momentum? Since the velocity of the cosmic ray proton is greater than c, we use the equation for *c*. (Also note that in Eq. (9), at high velocities $v = \rho V$ closely approximates *c*.) Thus $E \approx Pc$, and

$$P \equiv \gamma mv = mV \approx \frac{E}{c} = 5.34 \text{ x } 10^{-3} \text{ g-cm/s} . \tag{11}$$

Note: As stated prior, in my work there are two velocities, one observed and one actual. Velocities given here are the actual ones. In using the actual (Newtonian) velocities, the Lorentz ρ is inapplicable, but ρ is supplied by Eq. (9).

Nikola Tesla, the discoverer of cosmic rays, stated that they traveled faster than light, but he was not able to figure out just HOW fast. The author was fortunately able to do so.

Physicists will look at over 100,000,000,000 *c*, and choke with disbelief. But when they see that ρ, placed in Einstein's equation, gives the correct energy, they must accept it.

The ρ of the velocity placed in Eq. (9) also produces the correct energy. However, in the case of Einstein's equation it is the mass that increases whereas in the case of Eq. (6) it is the velocity that increases. Since it may be assumed the proton travels bare, this indicates Eq. (6) is the proper equation, which in turn means the proton travels at the super *c* velocity. [1]

3. Conclusion

It is commonly asserted that cosmic ray protons travel at "very near velocity *c*". If so, the only way they could posses the energy they have is if they had a mass of 1.783 x 10^{-13} g, a 1.066 x 10^{11} increase. This would require acceptance of relative mass – which we know does not exist. Therefore, the ONLY way the proton could deliver that energy is if it traveled at a higher (super *c*) velocity.

There is a counter argument to the effect that the impelling force for protons is electromagnetic – and as happens in an accelerator, the proton absorbs such and thereby gains in mass. And that is what the Einstein equation shows. So that increased mass and virtual *c* account for the energy.

However, there is a consideration that negates that counter argument. And that is, the mass built up will maintain only as long as the particle is under bombardment. Once that ceases, the mass is given off as radiation – "cyclotron radiation". So then we might expect that once the protons are in free space, they will shed the mass build up and travel at their bare mass. Hypothetically, the radiation given off may well be the afterglow that is observed after the cosmic ray burst.

It may be remarked that the development of the proton velocity collaterally verified the Dual Velocity Theory of Relativity and the existence of super *c* velocities.

References

[1] Vertner Vergon, **A Diagnosis of Special Relativity** (Vertner Vergon, 2001), see "The Dual Velocity Theory of Relativity".